

It will be noted that at Delaware the estimated minimum by the hygrometric method was within 3 degrees of the actual 22 times out of the 28 cases, and was 5 degrees too low twice and 5 degrees too high once. Using the temperature-range method, the estimate was within 3 degrees of the actual 13 times out of the 28 cases, was once 9 degrees too low, and once 7 degrees too high. In 26 cases using the median-temperature method, 18 times the estimated was within 3 degrees of the actual, twice being 6 degrees too high, and once 3 degrees too low. By using the mean of these three computations we find that in the 28 cases considered the computed was within 3 degrees of the actual 26 times, and that it was once 5 degrees too low and once 4 degrees too high.

CONCLUSIONS.

It seems probable that formulæ may be prepared by two years' thermograph records and whirled psychrometer observations that will permit the making of very accurate minimum temperature forecasts under radiation conditions at any specified point, and further that longer carefully made records will permit of establishing rules that will be widely applicable to places under similar topographic and atmospheric surroundings. The method of hygrometric equation has an advantage in the fact that the dewpoint and relative humidity observations may apparently be made at any convenient hour in the late afternoon or early evening. After the observations have been reduced, and the values of a and b determined, it is then very easy to determine the variation of the minimum temperature from the evening dewpoint by the formula

$$Y = a + bR$$

in which R is the relative humidity at the evening observation and Y the probable variation of the minimum temperature from the evening dewpoint.

HISTORICAL NOTE.

By CHARLES F. MARVIN, Chief of Bureau.

The subject matter of this paper, as regards the prediction of minimum temperatures by means of the so-called median temperature and also the method based on the evening dewpoint and relative humidity, was fully presented by Prof. Smith in a paper submitted August 14, 1915. Publication was deferred at that time because of scantiness of certain data bearing on the question of the change in dewpoint throughout the night, and from other considerations. This lack of data has since been removed and the conclusions of the original paper are herein now seen to be fully confirmed.

Attention is called to the circumstance that as early as 1910 Charles A. Donnel, in analyzing certain special observations made at Boise under the direction of Edward L. Wells, for the purpose of predicting minimum temperatures, noticed that when the evening relative humidity was about 55 per cent, the minimum temperature was about the same as the evening dewpoint. Subsequently, Mr. Wells in a personal report to Mr. Beals, at Portland, Oreg., dated August 9, 1912, stated the relation Donnel had pointed out in the following equation:

M = expected minimum temperature, at orchard level.
 D = dewpoint at 8 p. m., at orchard level.
 R = relative humidity, at 8 p. m., at orchard level.

Then,

$$M = D - \frac{R - 45}{5}$$

This matter was briefly alluded to by Mr. Beals in his bulletin "Forecasting Frost in the North Pacific States," page 17.⁴

During 1917 Floyd D. Young, detailed from the Portland, Oreg., station to manage the spring frost warning service at Medford, Oreg., reported at some length on his utilization of the Donnel relation in that work. Mr. W. G. Reed, also engaged in frost protection investigations at Medford, Oreg., and familiar in a general way with Prof. Smith's investigations, has also studied the utility and application of this relation between the evening hygrometric state and the minimum temperature of the following morning.

It is interesting to observe the close similarity between the entirely independent investigations of Donnel and Wells on the one hand and Prof. Smith on the other. The mathematical identity of the two equations employed is easily shown.

Let M = morning minimum temperature.

Let D = evening dewpoint and R = relative humidity.

DONNEL.

$$M = D - \frac{R - n_1}{n_2}$$

in which n_1, n_2 are two numbers deduced from study of data.

$$M - D = \frac{n_1}{n_2} - \frac{1}{n_2} R$$

Let

$$M - D = Y, \quad \frac{n_1}{n_2} = a, \quad \frac{1}{n_2} = b.$$

$$\therefore Y = a - bR$$

$$.55/.524 (47+57)$$

THE LOWEST AIR TEMPERATURE AT A METEOROLOGICAL STATION.

While works on meteorology generally agree in stating that the lowest temperature ever observed at a meteorological station (not including upper-air observations) was recorded at Verkhoyansk, Siberia, the value of the reading and the date of occurrence have been variously stated. The following letter on this subject is in reply to one addressed to the late Prince Boris Galitzin (Russian, Golitsyn), director of the Nicholas Central Physical Observatory, Petrograd. The reference in the last paragraph is to Prof. A. Voeikov's "Meteorologia," St. Petersburg, 1910, p. 73, where the absolute minimum at Verkhoyansk is given as -72°C .—C. F. Talman, Librarian.

OBSERVATOIRE PHYSIQUE CENTRAL NICOLAS,
 Petrograd, Dec. 2, 1915.

Prof. C. F. MARVIN.

Chief Weather Bureau.

Washington, D. C.

DEAR SIR: In answer to your letter [of] October 4, 1915, about the lowest temperature of air in Verkhoyansk, I can refer you to what follows:

The lowest temperature was noticed by the observer at Verkhoyansk the 5th and 7th of February, 1892. The observations were made by means of the alcohol thermometer Müller No. 81*: the direct reading on this thermometer was -68°C . [$= -90.4^\circ\text{F}$.] This thermometer, No. 81*, was verified in the Central Physical Observatory, but only

⁴ Beals, E. A. Forecasting frost in the North Pacific States. Washington, 1912. [12 figs.], 49 p. 8°. (Weather Bureau Bull. 41.) (W. B. No. 473.)